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Gleaming Necklaces Are Harvest of a Japanese Pearl Farm—Mississippi mussels contribute bits of their shell as "seed" for this precious crop grown in Honshu waters.

NATIONAL GEOGRAPHIC PHOTOGRAPHER J. BAYLOR ROBERTS

Mikimoto soon girdled the world with his pearl salons. He pushed production until he had 12,000,000 oysters working for him, creating about 75 per cent of the world's supply of pearls.

Oyster Makes Pearl in Defense—Mikimoto's "secret" was to simulate nature. A natural pearl forms when a particle of sand, a shell fragment, or a tiny parasite infiltrates the oyster shell. In self-protection the oyster coats the irritating foreign matter with layer after onionlike layer of lustrous secretion.

For centuries, the Chinese had inserted tiny lead or tin Buddhas into fresh-water mussels and obtained small pearl gods attached to the shell. Linnaeus, famous 18th-century botanist, demonstrated the possibility of producing pearls in the fresh-water mussels of Sweden. But Mikimoto was first to produce high-quality spherical pearls inside the body of the oyster itself.

In Japanese coastal waters today sun-tanned girl divers dressed in white put out in small sampans, singing folk songs. The girls toss big wooden tubs overboard. Pulling glass masks over their faces, they leap into the water, then bob up again with their "catch" of three-year-old oysters planted earlier as young spat in carefully selected beds.

Taken ashore to the "pearl plant," the adolescent oysters are opened by experts who insert tiny "seeds" to form the nucleus of a pearl—pellets of fresh-water mussel shell from the Mississippi River. A recently developed "anesthetic" has cut the mortality rate of oysters operated on from 50 per cent to 10 per cent.

Convalesce in Cages—The doctored oysters convalesce in wire cages lowered about ten feet into calm bay waters and suspended from log rafts. Here they remain safe from the hungry eel, starfish, and octopus. Twice yearly the pampered oysters are raised for a check-up. A manicuring removes barnacles, seaweed, and other matter not conducive to the oyster's well-being. A "medical chart" accompanies the oyster in the form of a tag on the cage.

When seven years old, the oyster is harvested from the sea and opened. One in twenty yields a valuable pearl. Washed, graded, polished, drilled, and strung in necklaces, the pearls are ready for market. The United States takes 70 per cent of the Mikimoto output, the rest of the world 30 per cent.

Until his recent death at 96 Kokichi Mikimoto actively supervised every phase of operation on his 11 pearl farms, dressed in a brown kimono and black derby hat. He worried his devoted employees by plunging in for swims even when in his 90's, and amused them by lying on his back and twirling an umbrella with his feet.

He delighted in entertaining guests at his Pearl Island home with oysters on the half shell, each containing one or more pearls. He once held a memorial service for all the oysters "martyred" to make him rich.

For years Mikimoto held a monopoly on his method. Now other Japanese pearl farms market their products. All this spells only further hardship for the world's natural-pearl industry.

More than 3,000 years ago Singhalese divers were bringing natural pearls from the floor of the Gulf of Mannar off Ceylon. Pearls were listed

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A fortune lies on the ocean floor along the rocky coast of southern Honshu, in Japan. Not the golden treasure of sunken galleons but pearls, farmed by white-robed mermaids. These girl divers help produce a multi-million-dollar crop each season.

The art of annoying oysters into producing spherical pearls of ideal luster was perfected by Kokichi Mikimoto, the "pearl king." A former noodle vendor, he became one of the world's richest men.

Born of poor parents in the coastal town of Toba, in Mie Prefecture, Mikimoto moved on from noodles to a shop of his own. Then a visit to Tokyo revealed to him the tremendous demand for sea food. Forthwith he became an oyster farmer.

From oysters to eat to those producing pearls was but a step. But that one step required countless experiments and 23 years of work. Finally by 1913 Mikimoto had mastered his process. He could now produce pearls indistinguishable from the natural. Only X-rays could detect the difference. He showed his pearls in Paris, pearl mart of the world, creating a sensation by offering them at one-fourth the going price. French courts backed his claims that they were genuine, not artificial.

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NATIONAL GEOGRAPHIC PHOTOGRAPHER J. BAYLOR ROBERTS

Yellow Bus Displaces Little Red Schoolhouse

Gone are the days of Grandfather's proud boast that he rose at dawn to chop wood for the schoolhouse stove. Schoolgirls no longer push through snowdrifts to a one-room school as Grandmother did. The big yellow bus, bowling along concrete highways or newly improved county roads, is pushing the little red schoolhouse off the American landscape.

Some 45,000 one-room schools remain, but their number is shrinking at the rate of ten a day.

School districts have combined. Imposing structures of brick, steel, and glass, each housing hundreds of pupils and ten or more teachers, are replacing tiny buildings where four to eight grades studied and recited side by side in a beehive din.

Educators feel the advantages of consolidation outweigh good points of the little red school. Better-paid, better-trained teachers can now give each class their undivided attention. Students gain from contact with larger numbers of their own age group. Larger buildings offer better facilities at a lower cost per pupil.

The one-room schoolhouse—red, white, or the weathered hue of hand-cut logs—molded the thinking of millions. Generations of Americans have built nostalgic memories of their youth around the harsh clang of the recess bell or the prank that meant staying after school. Even the hickory switch has become a symbol of happy, carefree days.

Sometimes school meant respite from bodily toil. In a little backwoods shack at Knob Creek in his native Hardin County, Kentucky, Abraham Lincoln interrupted chores long enough to learn "to read and write, and cipher to the rule of three."

To Redstone school, in Sterling, Massachusetts, Mary Sawyer's little lamb followed her one day, inspiring the poem. Later, the school became a garage, to be rescued by Henry Ford and moved to South Sudbury, Massachusetts. Recently 206-year-old Quasset school in Woodstock, Connecticut, was dedicated as a permanent shrine.

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NATIONAL GEOGRAPHIC PHOTOGRAPHER J. BAYLOR ROBERTS

Oyster Yields Culture Pearl—A girl worker removes from a seven-year-old oyster a Mikimoto gem, soon to become part of a beautiful necklace.

as tribute or tax in China 41 centuries ago, and ancient Chinese used pearls as charms against misfortune. Wealthy Romans ground them into fine powder to mix with their wine. Medieval European "doctors" mixed pearls with 33 other ingredients to produce a cure for "all the ills that flesh is heir to."

As divers went into the waters of the Persian Gulf, the Sulu Archipelago, the South Seas, the Americas, a folklore of pearling emerged. Pearl fishers of Borneo are said to place every ninth pearl they find, together with two grains of rice, in a bottle stoppered with the finger of a dead man. These bottled pearls are believed to have the power to breed others. Bahrein divers maintain that pearls are formed by rain drops caught by oysters at night.

Shark Charmer Protects Divers—In Ceylon waters no brown-skinned diver will descend into the lair of the tiger shark without the "protection" of the shark charmer. The holy man's charm has to be renewed—at a price—for each day's fishing.

The dangers of the deep are real to the pearl diver. Besides the shark he fears the dread manta ray, the sawfish, the giant squid, the vicious moray eel with its rows of razor-sharp teeth. Thursday Islanders, in Torres Strait off northeastern Australia, watch for the 500-pound giant clam. This can clamp a death grip on an arm or leg.

Pearling fleets have dwindled and rich strikes—such as the $75,000 Persian Gulf pearl of 1929—are now rare. But the lure of ocean-floor treasure still returns men to the oyster beds.

With the advent of culture pearls Cleopatra's gems are no longer restricted just to the few. Kokichi Mikimoto once dreamed of giving every woman in the world the opportunity to possess a pearl necklace. He went far toward realizing that goal when he learned to make his pearls.

References—Mie Prefecture, center of the Mikimoto culture-pearl industry, is shown on the National Geographic Society's map of Japan and Korea. Write the Society, Washington 6, D. C., for a price list of maps.

See "Japan Tries Freedom's Road," *National Geographic Magazine*, May, 1950; "Exploring the World of Gems," Dec., 1950; "Bahrein: Port of Pearls and Petroleum," Feb., 1946; "On the Bottom of a South Sea Pearl Lagoon," Sept., 1938; "Pearl Fishing in the Red Sea," Nov., 1937; "Fishing for Pearls in the Indian Ocean," Feb., 1926 (out of print; refer to your library). *(School and library discount price for Magazine issues a year old or less, 50¢; through 1946, 65¢. Send for prices of earlier issues.)*

The crude compass it holds is the average dhow's only navigating aid. With no charts, barometer, or log, the *nakhoda* (master) has only Allah and experience to guide him through reef-strewn waters.

Dhow rigging has no ratlines or foot ropes for work aloft. Seamen scramble up the 130-foot lateen yard (left) merely on lines lashing the sail and the spar's three tree trunks together.

An Iranian *baggala* (below) unloads Malabar teak from India near Muscat on the Arabian peninsula. One of the last of her kind, this deepwater dhow traces high-pooped hull and windowed stern cabin back to Portuguese caravels of Vasco da Gama's time, 450 years ago.

Few Western sailors ever ship aboard Araby's wooden-pegged vessels, whose voyages often are devious and whose masters always are wary of infidels. For the story of one who did, see "Sailing with Sindbad's Sons," by Alan Villiers, in the November, 1948, issue of *The National Geographic Magazine*. This modern-day Joseph Conrad's latest article—"Golden Beaches of Portugal"—appears in the November, 1954, issue.

PHOTOGRAPHS BY ALAN VILLIERS

Sons of Sindbad Sail the Eastern Seas

Between the Persian Gulf and Red Sea, from the Sultan of Zanzibar's domain to India's western ports, Arab dhows have sailed since before the days of Mohammed.

Like birds migrating on the winds, the graceful lateen-rigged vessels scud before the monsoons. For six months these seasonal winds blow southwest across the Indian Ocean, moving southbound cargoes of dates, dried shark, Persian carpets, and pearls. They then reverse to belly the sails of northeast-headed dhows bearing coffee, coconuts, mangrove poles, and pilgrims to Mecca.

Sunscorched crewmen tend the great triangular sail of a Kuwait boom (above), marked by teakwood nose. The turbaned quartermaster puffs his water pipe before a brass binnacle bought in a Bombay junkyard.

The crude compass it holds is the average dhow's only navigating aid. With no charts, barometer,

Along the busy Corso well-filled shops, cafés, and theaters greet the visitor. But he needs a well-filled purse, for *lira* prices are high. *Caffè espresso,* served in little cups, is the Triestino's favorite drink.

Vineyards and orchards cling to the thin, rocky soil of hillsides that squeeze Trieste against the sea. Streams cut deep gullies in the porous limestone of the countryside, where hard-working farmers use primitive implements to raise cereals and fruits—mainly olives and grapes. Instead of posts, wires strung between olive trees often support the vines. Small herds of cattle graze stony pasturelands.

NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART

A Quiet Basin of Trieste's Busy Triple Harbor Gives Haven to a Coastwise Sailing Ship

Along narrow country roads farmers transport their crops to market by oxen, donkeys, and an occasional rickety horse. With draft animals scarce and motor vehicles scarcer, visitors sometimes see a forlorn animal harnessed to one side of a two-horse cart.

Villages dotting the Istrian coast send out boats to bring in rich harvests of Adriatic fish. One of these harbors, Capodistria, the Yugoslavs plan to develop into a modern port to export Istria's bauxite, coal, marble, and salt. Meanwhile, they freely use Italy's port of Trieste under the new agreement.

May's fragrance of chestnut and locust blossoms gives way to blazing hot summers. Winter seldom freezes Trieste's harbor but brings the *bora*. This frigid wind sweeps down over the Julian Alps to buffet the harbor with 100-mile gusts. Stone walls built to windward of certain stretches of railroad keep trains from being blown off the tracks.

The dividing line drawn by the British-United States-Yugoslav commission brings strange and disconcerting problems into the lives of Italian and Yugoslav alike. One Italian farmer stood by in dismay while commission workers painted a yellow stripe across his home, mapping the kitchen into Italy. The rest of the house, the stable, and the vineyard stand in Yugoslavia, now to him an alien land.

References—Trieste appears on the Society's map of Europe and the Near East. See "Trieste Problem Plagues Statesmen," GEOGRAPHIC SCHOOL BULLETINS, Jan. 18, 1954.

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Trieste Now Flies Italy's Tricolor

Trieste, orphan of the Adriatic, no longer is a city without a country. From flagpoles on the central Piazza del Unita, from the bell tower of San Giusto Cathedral on the city's rocky heights, the Italian tricolor now splashes its red, white, and green against the bright blue sky.

By a Solomonlike decision, what recently was the United Nations' Free Territory of Trieste has been divided between Italy and Yugoslavia. This territory curves like a horn of plenty around the western shoulder of the Istrian Peninsula, a rocky projection shaped like an Indian arrowhead that points south at the head of the Adriatic.

Trieste city is home to about 300,000 people, 80 per cent of whom are Italian. Energetic, proud of being *Triestini*, they look to the sea and the railroads leading north as their city's lifelines. South of the city limits, Yugoslavia absorbs about two-thirds of the territory's 285 square miles, but only 75,000 people, mostly Slavs.

Italian forces replacing United States and British occupation troops find a city showing traces of many masters during its long and colorful history. Broken columns recall Rome's Tergeste, fortified under Caesar Augustus. The city's cathedral rises over a ruined temple to Minerva, Juno, and Jupiter. The fortress of San Giusto occupies the site of the Roman forum.

Once Austria's Window on the Adriatic—Stolid baroque buildings and Trieste's fine port are the heritage of the Austrian Hapsburgs, who followed on the heels of Goths, Lombards, Byzantines, Carolingian Franks, and Venetians, and stayed more than 500 years—from 1382 to 1919. Except for brief periods under Napoleon, Trieste was chief port of the Austro-Hungarian Empire. Great shipping companies and commercial houses looked out over a thriving harbor-front which formed a gateway to Vienna and other great cities of Central Europe.

Near Trieste, a century ago, the Archduke Maximilian built a gleaming white castle, Miramare, before sailing for his ill-fated empire in Mexico. Franz Ferdinand, Hapsburg heir, lived there. His assassination at Sarajevo touched off World War I, which cost the Austrians Trieste.

Italian between World Wars, Trieste reeled under Allied air bombardment when it served as a leading Axis supply base for Rommel's African campaigns.

After 40 days of Yugoslav occupation at the end of World War II, Trieste, bone of contention between Tito and the Italians, came under United Nations supervision. American dollars helped rebuild docks and restore the shipbuilding yards that supported nearly half of Trieste's prewar citizens. Commerce once more flows through the harbor's three sections: the old port, a busy new basin for deep-draft ships, and the even older customs port, formed by the Grand Canal that cuts straight into the city for three blocks.

Oil refineries, the world's largest olive oil processing plant, a steel mill, iron foundries, chemical works, and paper, soap, jute, and textile mills again hum with activity.

The same restless vigor that shows in the city's clean-lined functional architecture, impatient of unnecessary ornament, carries back four centuries to when Portuguese Jesuit missionaries pushed 35 miles inland to found the settlement on January 25, 1554—St. Paul's day.

Sparked Brazil's Westward March—Hard-fibered colonists slave-raided Indian communities and trekked ever deeper into unexplored wilderness to carve out plantations and search for gold and diamonds. Such expeditions were called *bandeiras*. In so pushing past the Tordesillas treaty line demarcating Portuguese and Spanish zones in the New World, Paulistas wrested for Brazil nearly half of South America.

Coffee planting was already spreading across Nevada-sized São Paulo State by 1822 when the Regent, Dom Pedro, near São Paulo town, proclaimed Brazil's independence from Portugal. After mid-century, British capital linked the town by rail with Santos. A network of railroads fingered over the countryside. Only then did the plateau's jumping-off-place come into its own. As agricultural wealth of São Paulo State and mineral riches of neighboring Minas Gerais funneled through São Paulo to world markets, the city became the region's merchant, banker, and clearinghouse.

As hydroelectric power projects brought industry, coffee-rich São Paulo welcomed immigrants streaming in from Europe, even from far-off Japan. Italians, Germans, Hungarians, Turks, and others all take pride in calling themselves Paulistas, after the early settlers of Portuguese-Indian descent.

PETER SCHEIER, LIVRARIA KOSMOS EDITORA

This year the booming city is celebrating its 400th birthday. A $30,000,000 Fourth Centennial Exposition and International Trade Fair runs until January 25, 1955. Sixteen thousand construction workers toiled under hot sun and dazzling floodlight to erect inventive buildings designed by Brazilian architect Oscar Niemeyer, who helped design the United Nations buildings in New York. Winding, roofed promenades lead to exhibits

Carnival Time in São Paulo—An accordionist regales costumed belles as work-hard, play-hard Paulistas let down their hair in the pre-Lenten round of festivities.

São Paulo: World's Fastest Growing City

The blazing whiteness of Miami, the throbbing pulse and boisterous energy of Chicago, the dizzy canyon-walled streets of hustling New York, a touch of cosmopolitan Paris. Wrap these together, stamp them with a soft Portuguese accent, set them down on the fertile red-earth tableland of southeastern Brazil and you have São Paulo, the world's fastest growing city.

"A new building every thirty minutes," enthusiasts boast of Latin America's leading industrial city.

"Such stories!" laugh conservative Paulistas. "One an hour is more like it."

Actually, each day sees some 35 buildings completed; every week three new skyscrapers rise toward the clouds. But fast as bulldozers root out foundation sites, and steelmen pile girder on girder, São Paulo's population grows still faster. Glass and concrete offices, homes, and shops are bought and rented right off the architect's drawing board, months before they are built.

Population shot up thirtyfold in less than 60 years preceding the 1950 census. Estimates for 1954 push the city past 2,500,000, with the end nowhere in sight. São Paulo passed Rio de Janeiro, Brazil's capital, in 1953. Now it stands second only to Buenos Aires in all South America.

Land at São Paulo's airport and ride through traffic-choked thoroughfares that tunnel under and bridge over broad palm-lined avenues and you will be reminded of great northern cities. The United States of Brazil shares automobiles, Hollywood movies, and many goods in the stores with the United States of America. Too, you will find the same friendly, democratic ways, the optimism, the same tempo of life.

No Siesta for the Paulista—Siestas are forgotten in São Paulo's noon rush when office and factory workers cram open-sided streetcars to dash home for a quick lunch and back to work. The Paulista, unlike Rio's carefree Carioca, always seems to be hurrying somewhere. He even drinks the traditional *cafesinho* standing up, with no time for the café table's leisurely talk.

To relax, he dances the athletic samba or squeezes into the mammoth Municipal Stadium to shout his lungs out at a horse race or soccer match. After Sunday Mass he speeds along the highway that eventually winds down the brow of Serra do Mar (Sea Range) to the steamy port of Santos half a mile below. At the near-by resort island of Guarujá he works off surplus energy on gleaming sands and in rollers of the blue-green Atlantic.

Swimming in November surprises the North American visitor just come from a land where autumn's trees stand naked. In São Paulo he finds jacaranda trees blossoming smoke-blue above pink-flowered hibiscus hedges and gateways splashed red and purple with bougainvillaea. He learns that Christmas and New Year's fall in midsummer.

The Tropic of Capricorn slices through São Paulo's 580 square miles (larger than sprawling Los Angeles). Anyone averse to the tropics can thus step over into the Temperate Zone at will. Actually, São Paulo's altitude on the 2,700-foot plateau gives it a year-round bracing climate.

SIQUEIRA E SILVA, LIVRARIA KOSMOS EDITORA

Busy Thoroughfares Crisscross Downtown São Paulo, World's Coffee Capital

of many lands. Plastic-topped busses scoot between the Palace of Nations, the palaces of Agriculture, Industries, and States (Brazilian State exhibits), the planetarium, the midway, and the 20,000-seat stadium where championships in many sports will be decided.

Festivals, performances, conventions of every kind stud the year-long calendar of events. Displays range from damask to Diesels; industry to Indian-lore; historical pageants, art, and of course examples of São Paulo's own output of machinery, textiles, drugs, furniture, paper, and electrical goods. Crowds throng the dramatic United States display of peacetime uses of atomic power—"Atoms for the Benefit of Mankind."

Earlier this year the city swarmed with movie fans eager to glimpse Hollywood celebrities, glamorous French and Italian actresses, and sunglassed German directors arriving for the First Brazilian International Film Festival.

Today São Paulo's people are at work operating 15,000 industries and one of the world's busiest airports. They administer the State that earns half of Brazil's national income. With Texas-like pride they say, "São Paulo is the locomotive pulling the Brazilian train."

References—São Paulo may be located on the Society's map of South America. See "As São Paulo Grows," *National Geographic Magazine*, May, 1939; "Brazil's Land of Minerals," Oct., 1948; "Brazil's Potent Weapons," Jan., 1944; "Air Cruising Through New Brazil," Oct., 1942.